LIFE CYCLE OF MELESODECTES AURICULARIS FAIN & LUKOSCHUS (GLYCYPHAGIDAE, SARCOPTIFORMES)

by

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Abstract

Rearing of hypopi of *Melesodectes auricularis* Fain & Lukoschus, 1968, was successful. Morphology suggests relationship to Hypoderidae and Saproglyphidae.

Introduction

In a former paper Fain and Lukoschus (1968) described hypopus and tritonymph of this species found in the concha of European badgers. Hypopi lacking attaching organs on idiosoma (sucker plates or claspers) or on tibiae of forelegs show similarities to hypopi of the family Hypoderidae, but they have more primitive legs.

In the meantime we succeeded in rearing hypopi from badgers killed by trucks in the spring. We are very obliged to the Rijksinstituut voor Veldbiologisch Onderzoek (RIVON) at Zeist and to Dr. Franz Krapp, Zoologisch vergl.-anatomisches Institut Freiburg (Switzerland) for forwarding us parasitized conchae of badgers.

Methods and results of rearing experiments

Original material was obtained from the ears of European badgers (*Meles meles*): 28.III.1969 near Grimentz (Kanton Wallis), Switzerland, 17.IV.1969 near Freiburg, Switzerland, 20.IV.1969 near Vierlingsbeek (Prov. Limburg), the Netherlands. They were lactating females. A starved suckling 20.IV.1969 near Vierlingsbeek.

The conchae sent to us were partly scraped out, other parts containing hypopi have been divided into pieces with:

1) only epidermis, with ear-wax; 2) epidermis with fatty connective tissues; 3) concha, fatty tissues and muscular tissues.

The ear pieces were placed into glass tubes plugged by cotton wool and kept in darkness at room temperature and at constant relative humidity of: a) 75%, b) 85%, c) variable humidity by wetting of the cotton stopper twice a day.

A similar technique has been utilized with success by Fain (1968, 1969b and 1969c) to obtain the development of the hypopi of several other species of Glycyphagidae.

Hypopi and ear-wax scraped off were placed in glass tubes with:

4) yeast; 5) evaporated milk; 6) oatmeal and yeast; 7) pollard and yeast; 8) skin scales, yeast, evaporated milk; 9) skin scales, yeast, oatmeal and pollard.

The tubes were kept under the humidity conditions mentioned above. In all rearing

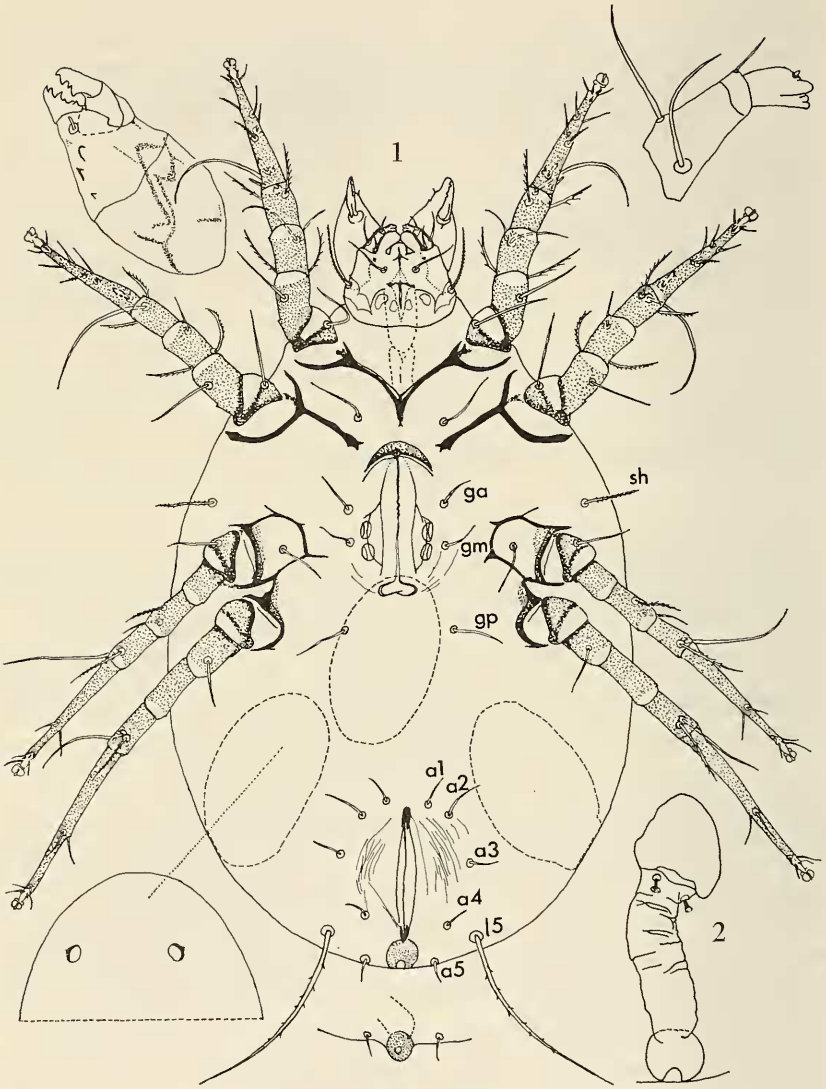

Fig. 1, 2 — *Melesodectes auricularis* Fain & Lukoschus, 1968. 1) female venter, 2) bursa copulatrix. *a1-a5* anal setae, *g a* genital anterior, *g m* genital median, *g p* genital posterior, *s* lateral setae, *sh* subhumeral

media and humidity conditions partial rise of tritonymphs was observed, but development to adults only in the tubes with ear parts, further development to larvae and protonymphs only in tubes with fatty tissues.

At 85% relative humidity mould cultures were developing, but mites were not observed to feed on them. Best results were obtained with 3) concha + fatty tissues + muscular tissues at variable humidity.

In this rearing experiment one of us (F.L.) noted as shortest developmental intervals: 17.IV.1969 death of badger, shipment of ears; 20.IV. arrival at Nijmegen, tritonymphs present, starting of rearing experiments; 21.IV. first adults; 22.IV. first copulations; 24.IV. first eggs; 26.IV. first larvae; 29.IV. first protonymphs; 4.V. all mites dead without forming of hypopi; large numbers of larvae developed to only few protonymphs.

Tests of reproduction capacity by placing newly hatched adult couples into rearing mixtures 8 and 9 proved to be ineffective, only three of 15 couples laid up to four eggs (2, 3, 4).

Function of thickened legs II of male could be observed in copulating pairs. Tibiae IV of female are grasped by the clasper formed by apophysis on femur and tibia of male leg II. Frequently but not always, also tibia or tarsus of leg III of female is grasped by male tarsus II bent backwards.

Transfer of larvae to rearing media 5—9 did not result in rise of protonymphs.

On the suckling badger, the mother of which had parasitized ears, no hypopi or other developmental stages of this species were found in the ears nor between the hairs of the fur. On the ventral side of the abdomen and on the inner side of femora of hind legs small injuries of the epidermis were observed.

In skinning with the aid of a dissecting microscope in these parts and ventrally on thorax 16 hypopi were found in the connective tissue, partly in the muscular tissue, partly in the tissues attached to the skin.

Systematical position of the genus *Melesodectes* and of the subfamily Melesodectinae

Until adults of the genus *Melesodectes* were investigated by us, we ranged it among the Glycyphagidae. From the discovery of both adult forms and larvae it now appears that this genus also shows some characteristics known from Saproglyphidae.

Zachvatkin (1941) has divided Tyroglyphoidea (= actually Acaroidea) in three families, of which characteristic data are summarized below:

1) Tyroglyphidae (= actually Acaridae): Tarsal claws sessile and connected with tarsus by two sclerites. Idiosoma with distinct sejugal furrow. Cuticle smooth, small and colourless. Hairs of hysterosoma neither pectinated nor leaf-shaped. Female without epigynium. Male with well developed adanal suckers and two suckers on tarsi IV. Genital suckers well developed, digitiform. Organ of Claparède ("Bruststiele") well developed in larva.

2) Saproglyphidae: Tarsal claws small, ambulacrum situated on top of a long pretarsus and not connected with tarsus by two sclerites. Idiosoma with distinct sejugal furrow. Cuticle smooth or distinctly striated, membranous. Idiosomal hairs smooth and piliform. Female with or without epigynium. Male without adanal or tarsal suckers (except in the genus *Pontoppidania* Oudemans where these suckers are present). Genital suckers generally disciform. Hairs *v e* are lacking. Organ of Claparède well developed.

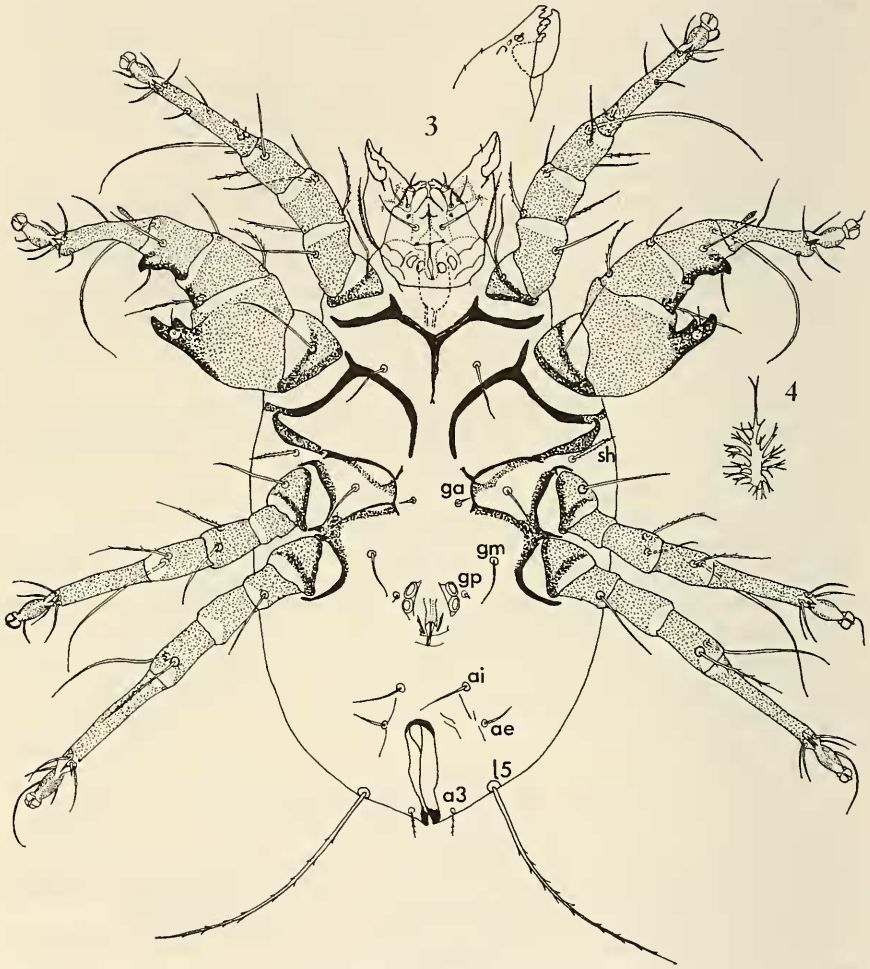

Fig. 3, 4. — *Melesodectes auricularis* Fain & Lukoschus, 1968. 3) male, venter, 4) supracoxal seta

3) Glycyphagidae: Tarsal claws as in Saproglyphidae. Sejugal furrow usually lacking. Cuticle thick, coloured and often with patterns or verrucous. Idiosomal hairs variable, rarely piliform. Male without adanal or tarsal suckers. Epigynium generally present in female. Genital suckers usually present, but slightly developed (disciform, rarely digitiform). Hairs *v e* generally present. Organ of Claparède reduced.

The genus *Melesodectes* shows claws similar to those in Saproglyphidae and Glycyphagidae. The sejugal furrow is present, but is only slightly characterized and may even quasi disappear in swollen specimens. Cuticle slender, colourless without patterns nor verrucous; however, on certain parts of the body of the less swollen specimens, some very narrow irregular ridges can be observed. Hairs of idiosoma are piliform, carrying short and only few barbules. The female shows a well shaped epigynium. The male is

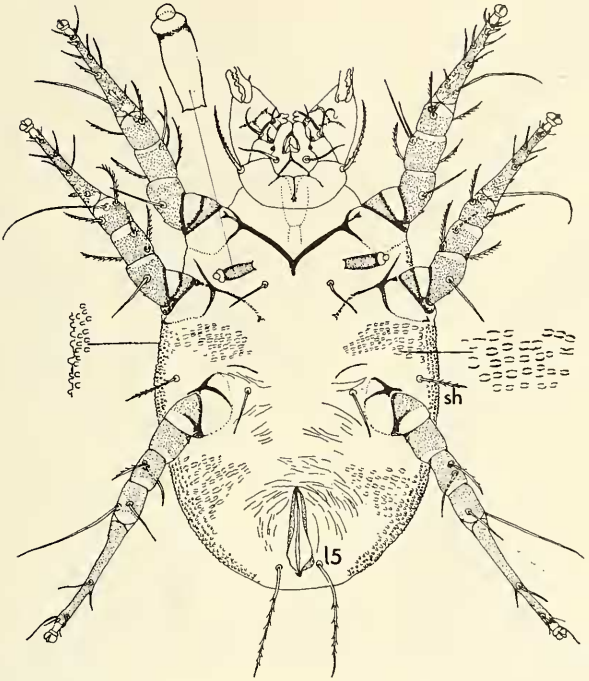

Fig. 5. — *Melesodectes auricularis* Fain & Lukoschus, 1968, larva, venter

devoid of adanal or tarsal suckers. The genital suckers are very short, almost disciform. In the larva the organ of Claparède is well developed. Finally the tarsi appeared to be long and narrow, particularly in the female.

Some characteristics, such as the presence of the sejugal furrow, the weak and smooth structure of the cuticle, the well developed organ of Claparède, bring this genus close to the family Saproglyphidae. However, this genus does not fully fit into this family, because of the presence of the hairs *v e*, the slight development of the sejugal furrow, the distinct elongation of the tarsi, and the branched shape of the supracoxal hair. In view of these characteristics it may rather be ranged among the Glycyphagidae. Actually, it forms a different group, intermediate between these two families.

With respect to the hypopus, it cannot be ranged among any of the three families of Acaroidea, because of its deviating character.

Hence our supposition may be justified to maintain this genus in an independent subfamily (Melesodectinae) and to range it provisionally within the family Glycyphagidae.

Female: Idiosoma egg-shaped, length except gnathosoma average of 24 specimens measured 564 μ (464—664), width ø 400 μ (291—455). Cuticula smooth, without epidermal structures or coloured pattern, with some irregular striations or wrinkles.

Venter (Fig. 1): Epimera I fused in Y-chape, epimera VI fused with epimerites III, forming closed coxal fields. Genital opening between epimera II and III; epigynium

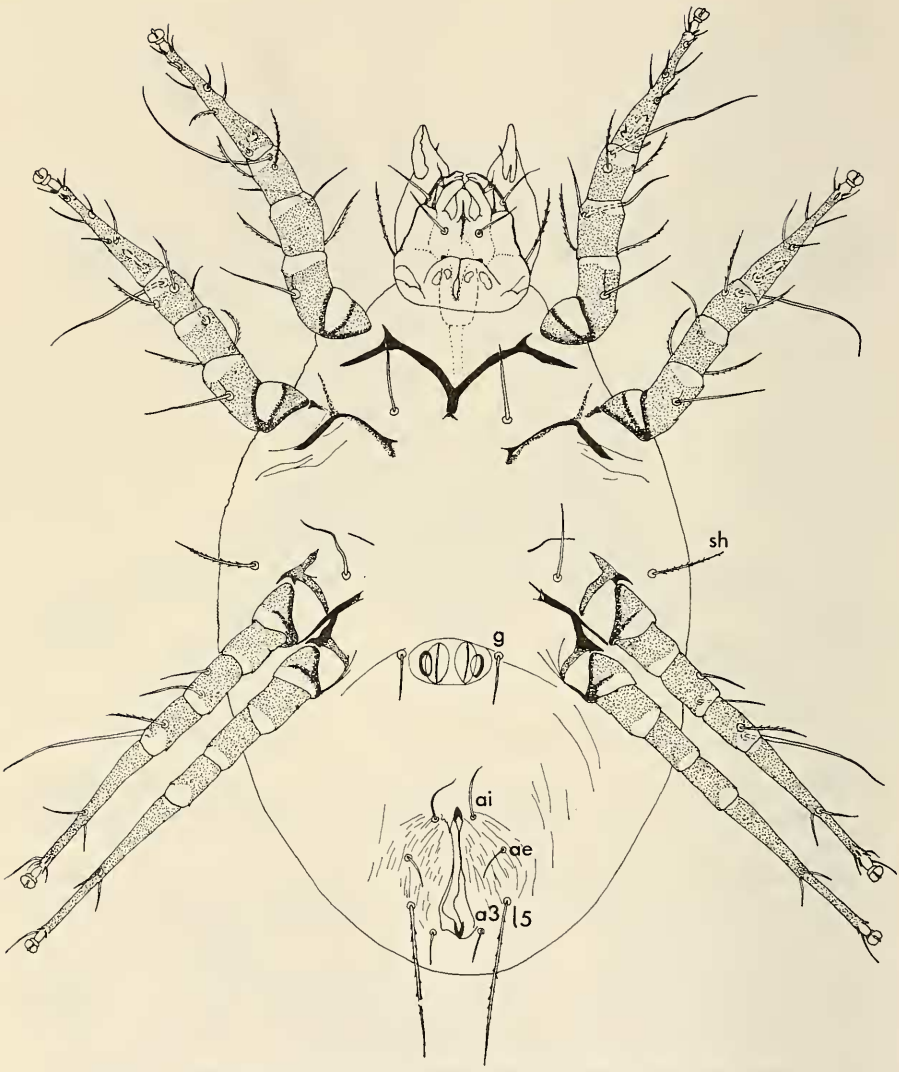

Fig. 6. — *Melesodectes auricularis* Fain & Lukoschus, 1968 protonymph venter

sickle-shaped and well sclerotized. Two vulvar valves without genital apodemes. Disc-shaped short genital suckers beneath vulvar valves. Anal opening ventral subterminal (129 μ long). Bursa copulatrix (Fig. 2) opens terminal in a more sclerotized chamber, protuberant in part of the females. Bursa 150 μ long and relatively very wide, spermatheca soft and only somewhat larger than bursa. Two cup-like appendages near mouth of spermatheca. Ventral hairs setiform: *g a* (40 μ), *g m* (40 μ), *g p* (54 μ), *a 1* (30 μ), *a 2* (45 μ), *a 3* (29 μ), *a 4* (25 μ), *a 5* (24 μ). Dorsal setae translocated to venter, pectinated: *s h* (55 μ), *l 5* (210 μ).

Gnathosoma: Pedipalpal coxae with two pairs of setae, lateral of them pectinate. Pedipalps with two segments, proximal segment with two setae, distal with one seta, one solenidion and button-like proximal protuberances. Chelicerae heavily dentated with little mandibular spine and four conical spurs.

Legs with five free segments, all tarsi elongated. Single little claw on lengthened pretarsus. Chaetotaxy of legs: tarsi 12-12-10-10, tibiae 2-2-1-1, genua 2-2-1-0, femora 1-1-0-1, trochantera 1-1-1-0, coxal fields 1-0-1-0.

Solenidiotaxy: Tarsi 3-1-0-0, tibiae 1-1-1-1, genua 2-1-1-0, famulus present on tarsus I (Fig. 17,18).

Dorsum (Fig. 8): Sejugal furrow indistinct and only in median part. All dorsal setae with exception of *v e* (25 μ) pectinate. *v i* (90 μ) in front of smooth *v e*. Supracoxal setae (Fig. 11) branched and forked with small organ of Grandjean, *sc e* (225 μ) four times as long as *sc i* (57 μ), *d 1* (60 μ), *d 2* (29 μ), *d 3* (385 μ), *d 4* (140 μ), *d 5* (255 μ), *l 1* (65 μ), *l 2* (50 μ), *l 3* (33 μ), *l 4* (280 μ), *h* (198 μ). Pore of oil gland medially to lateral 3.

In gravid females up to five eggs with well developed shells are observed. In freshly deposited eggs the shell has a honeycomb pattern, when observed under the dissecting microscope, however, after mounting in Hoyer's mixture no shell structures are visible. In far embryonated eggs two small chitineous cup-like structures are present.

Male: Idiosoma length average of 20 specimens measured 406 μ (360-450), width ø 274 μ (252—302). General shape unlike female, because of distinctly brown coloured legs. Legs II strongly thickened, forming copulatory clasping organs.

Venter (Fig. 3): Epimera I long Y-shaped, epimera II and epimerites II forming almost closed coxal fields II, epimera III and IV fused. Genital opening behind legs IV, penis short. Two pairs of small disc-shaped genital suckers between very *g p*, *g m* 33 μ, *g a* 10 μ. Anus ventro-terminal, with only three pairs of anal setae. Gnathosoma as in female.

Legs thicker, tarsi shorter than in female, pretarsi longer, stalk much broader than in female (Fig. 17, 20). Legs II strongly thickened and specialized for clasping organs. Large two-pointed femoral apophysis and tibial spur-shaped pincers, supported by posterolaterally notched tarsus.

Chaetotaxy: Tarsi 8-8-6-6, tibiae 2-2-1-1, genua 2-2-1-0, femora 1-1-0-1, tochantera 1-1-1-0, coxal fields 1-0-1-0.

Solenidiotaxy: Tarsi 3-1-0-0, tibiae 1-1-1-1, genua 2-1-1-0. Famulus present on tarsus I (Fig. 19, 20).

Dorsum as in female. Setae insignificantly smaller than in female.

Larva: Idiosoma egg-shaped, length average of 14 specimens 208 μ (164—306), width ø 159 μ (99—216). Cuticula in freshly emerged specimens mammilated and irregularly striated, in fullgrown larvae smooth like in adults.

Venter (Fig. 5): Epimera I fused in V-shape, epimera II and III free. Organ of Claparède 28 μ long with long well sclerotized and coloured basal part, soft uncoloured ring and coloured end. Anus ventral subterminal without anal setae. Gnathosoma as in adults.

Legs almost like in female. Chaetotaxy of legs: Tarsi 12-12-10, tibiae 2-2-1, genua 2-2-1, femora 1-1-0, trochantera 0-0-0, coxal fields 1-0-1.

Solenidiotaxy: Tarsi 1-1-0, tibiae 1-1-1, genua 2-1-1. Famulus on tarsus I remarkably longer than in adults (Fig. 12, 13).

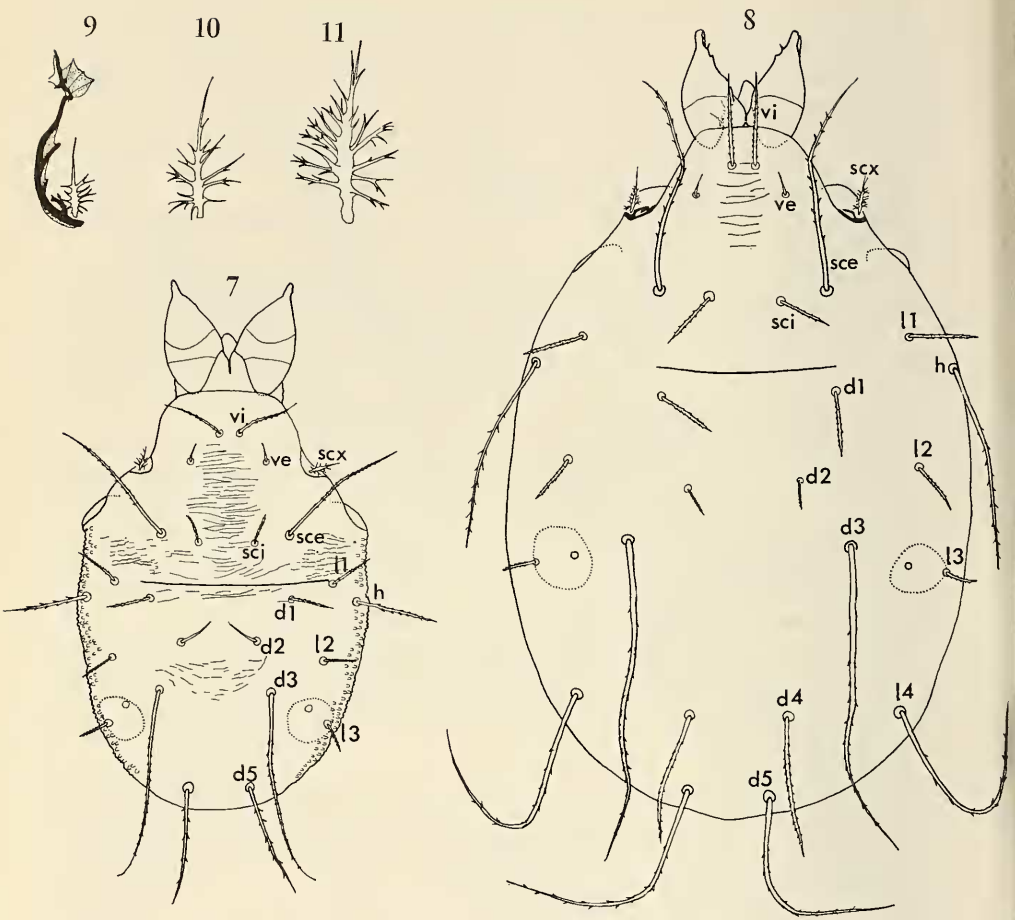

Fig. 7—11. — *Melesodectes auricularis* Fain & Lukoschus, 1968. (7) larva, dorsum, (8) female, dorsum, supracoxal setae of larva (9), protonymph, (10) and female (11). *sc* supracoxal setae, *d 1-5* dorsal setae, *h* humeral seta, *l 1-5* lateral setae, *ve* vertical external setae, *vi* vertical internal setae

Dorsum (Fig. 7): Idiosomal setae (lacking are *d 4* and *l 4*) with exception of *v e* and *d 2* pectinate and with the same length relations as in adults. Supracoxal setae (Fig. 9) branched and forked, Grandjean organ palmate (more distinct than in adults).

Protonymph: Length of idiosoma average of 14 specimens measured 357 μ (302—473), width ø 253 μ (198—338).

Venter (Fig. 6): Epimerae I fused in V- or very short Y-shape, epimerae II-IV free. Anus ventral subterminal with three pairs of anal setae. One pair of disc-shaped genital suckers and genital median setae between legs IV. Gnathosoma as in adults.

Chaetotaxy of legs: Tarsi 12-12-10-10, tibiae 2-2-1-0, genua 2-2-1-0, femora 1-1-0-0, trochantera 0-0-0-0, coxal fields 1-0-1-0.

Solenidiotaxy: Tarsi 2-1-0-0, tibiae 1-1-0-0, genua 2-1-1-0. Famulus present on tarsus I (Fig. 14, 15).

Dorsum like tritonymph, only length of setae somewhat shorter, supracoxal setae (Fig. 10) less branched.

Deposition of specimens

Adults and developmental stages have been deposited in:
Rijksmuseum van Natuurlijke Historie;
British Museum (Natural History);
Rocky Mountain Laboratory, Hamilton, Montana;
Field Museum of Natural History, Chicago;
Department of Zoology, University of Massachusetts, Amherst, Mass.;
Zoologisches Staatsinstitut und Zoologisches Museum, Hamburg; coll. nr. A22/71
U.S. National Museum, Washington;
Institute of Parasitology, Academy of Sciences, Praha;
Zoological Institute, Academy of Sciences, Leningrad;
Institut de Médecine Tropicale Prince Léopold, Antwerpen;
Zoölogisch Laboratorium, Katholieke Universiteit, Nijmegen.

Discussion

Morphological characteristics of hypopi, adults and larvae suggest relations to the family Hypoderidae (subcutaneous parasites of birds and rodents) and also to the family Saproglyphidae.

Genera of the subfamily Hypodectinae, parasites of birds, have a remarkable biology. Developmental cycles have been observed in *Hypodectes propus* Nitzsch, 1861, subdermal parasites of pigeons, by Fain and Bafort (1966). In this species free small hypopi are found in nests of pigeons during breeding time and also under the skin in nestlings. Within the tissue of birds these hypopi extend for 7—10 times. They rest within the tissues until the full-grown pigeon sits on eggs. Then the large tissue hypopi are eliminated by the bird and give direct development to adults. From the numerous eggs hatch free hypopi. Larval and protonymphal stages remain rudimentary within the egg shell. Development is shortened by lack of free living larvae, protonymphs and tritionymphs and in time development from large tissue hypopi → adults → reproduction → free hypopi to a short breeding period. Most absorption of food seems to be within tissue hypopus. There are no observations on feeding of the adults. Free hypopi get through little resistant epidermis of nestlings (Fain, 1967). Development is suggested to be affected by hormonal conditions of host while breeding.

Of the subfamily Muridectinae, subdermal parasites of rodents, neither adults nor developmental cycles have been observed (Fain, 1968, 1969).

Although in our rearing experiments the whole cycle, including forming of hypopi ex protonymphs, could not be observed, results may be compared. Development from hypopi to protonymph occurs within a very short time (shortest observed time: 12 days, in laboratory conditions). As lactation period in *Meles meles* lasts 12—14 weeks, there will be sufficient time for infection of nestlings, even if the development may be distinctly longer under field conditions.

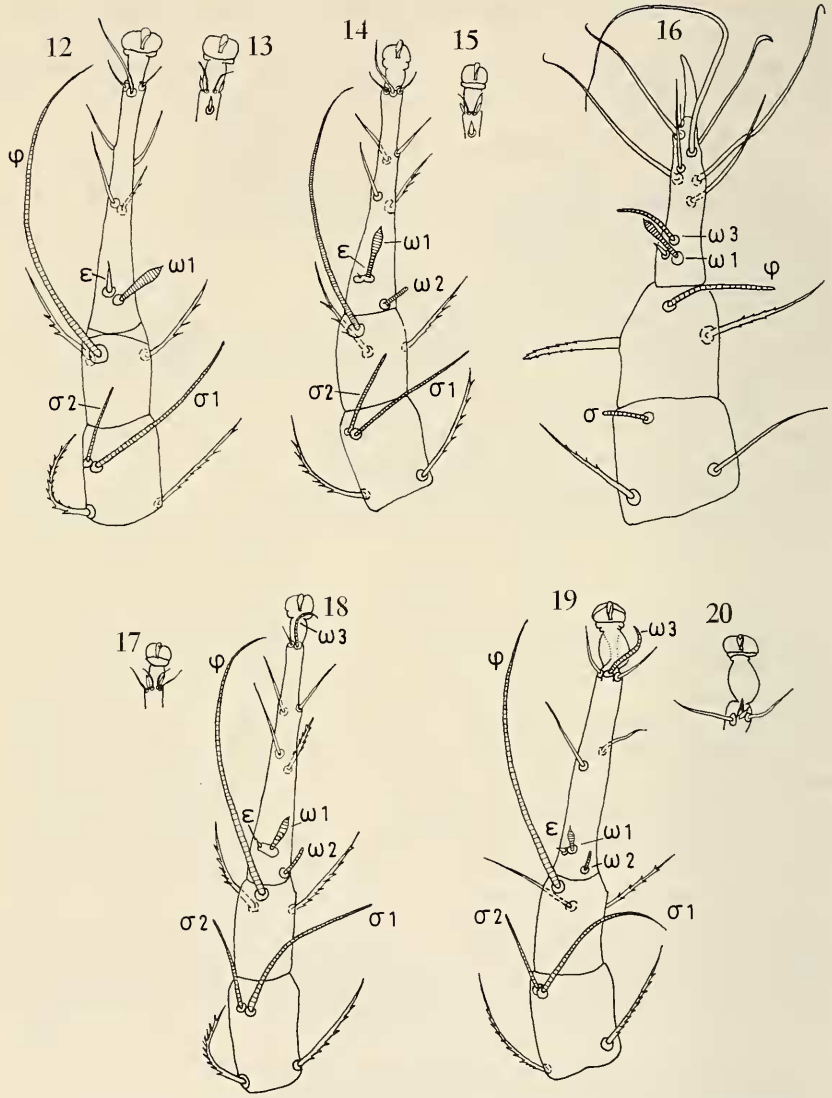

Fig. 12—20. — *Melesodectes auricularis* Fain & Lukoschus, 1968, leg I of larva dorsally (12), ventrally (13), of protonymph (14, 15), of hypope (16), female (17, 18) and male (19, 20)

Contrary to Hypodectinae, feeding of free living stages is necessary. There has been no development nor egg production without suitable food. Low numbers of developed protonymphs may be caused by shortage of food or decay.

It is interesting to mention that Fain (1969c, p. 758), working with hypopi of *Labidophorus talpae* and *Orycteroxenus dispar* from the mole (*Talpa europaea*), succeeded in obtaining the development of hypopi into tritonymphs, but was unable to rear

adults from the latter. It seems that here also the nymphs were unable to develop into adult stage in the absence of suitable food. In two other experiments this author (1968b and 1969b), working in Central Africa with the same technique, was able to abtain the development of endofollicular hypopi of the genera *Lophuromyopus* and *Rodentopus* into tritonymphs and adults. Free moving adults were obtained after a delay of 6 days. No food was provided during the experiment.

These experiments show that the development into the adult stage is variable according to the species involved. Some may require food, while other do not.

Failure of rearing mites on defined rearing media, fitted for most species of nest-inhabitant mites, suggests that *Melesodectes* is not a free-living nest-inhabitant, hypopi of which are phoretic on hosts for reaching new habitats, like *Xenoryctes krameri,* but a specialized monophageous parasite.

Successful rearing only on epidermis and fat tissue of the host suggests that in field conditions free living stages also feed on debris of host tissues present within the nests only during lactation period.

Observation of injuries and penetrated hypopi subcutaneous in a nestling shows close relations to Hypoderinae. The strong knife-like claws of hypopi (also typical in many Hypodectinae genera) may enable the penetration of the epidermis of nestling.

Presence of chitineous cup-like structures within the embryonated egg shows striking similarities to those in some families of host specific cutaneous mites like *Myialges anchora* (Oudemans, 1935), *Myialges macdonaldi* (Evans, Fain & Bafort, 1963) and *Gliricoptes betulinus* (Kok, Lukoschus & Fain, in press).

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